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INTEGRATION OF MOBILE BASED QUEUING SYSTEMS

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***Abstract*--The amount of time and energy that is wasted when people queueing for public services is a serious problem. More ever if the queuing done by busy or sick people. Due to the busyness, a person sometimes has to complete several matters at different places in short period of time. Therefore, we need a queuing system that is able to integrate all queuing services, so the public can do all queuing processes more comfortly without having to cram into a queue. In addition, by integrating all community of queuing services, someone can get the several services by only registering a single application. The working system of this application is to distribute information on service position and estimated waiting time. To design the system, a survey was carried out in several public service facilities in Makassar and Gowa Regency. Beside that, literature studies on similar papers were carried out. System planning, analysis and design were applied using the SDLC method. The results of this design is expected to be a model that can be used as an appropriate reference to implement integration of mobile-based online queuing systems.**

***Keywords* : Design and analysis; Integration system; Queuing system; Mobile system; SDLC.**

I. INTRODUCTION

Public services in several government and private institutions in Indonesia are still lack in providing services. We can see this situation in services queueing process, such as in citizen administration services, licensing or healt services like healt center and clinick. Queueing or waiting in line is a condition when few people, conponents or machines those need services must wait in line before get the services from one or more servants/service facilities. A queueing is happened when the ability to serve is less then the amount of those to be served. Generally, queuing system is clasified in various system. It has been more widely applied [1]. One of seven principles of new public services which suggested by Robert B. Denhardt [2] that might be a reference stated that the main role of the public services is to help people to articulate and fullfill their common interest, not to try to control them directly. The utilization of Information and Communication Technology (ICT), especially internet and mobile technology might be a solution for problems of the queue. Developing queuing sistem which easy to acces by the society might be concidered as one of public services innovation. Internet has been utilized in several ways, like the Internet of Things (IoT). IoT includes the communication between object with internet base [3], e-learnng [4], e-health [5], information media, and the memory storage [6]. Internet also propose virtual lives like sex, power, soscial relations, economic, ect [7][8] those feel real.

Queuing electronic systems hve been implemented in several places, but still there is a weakness, that is the procedure produced has no difference to the manual queuing system. The queuing electronic systems only transforming the manual application into electronic devices as its media. Most queuing service, both self-developed electric and manual queuing system have only solve a mesh or random queuing problem by makin the queueing be more straight.

Generally, queuing systems have not been able to parse the stuck of queuing or reduce customer waiting time. It is serious problems, because it makes them fatique and wasting a lot of time. Imagine when the elderly or sick people is the one who do the queueing, it will hurt them. As an example, when we consern about clinic service, we can see how many patients waste their time to be served by the nurse or by the health personnel. Meanwhile, according to Rondeau, customer satisfaction services very influential with quality waiting time. So that, organisation must manage their waiting time effectively, because a fail of giving confortness on waiting time can cause the unsatisfied costumer [9]. It means that improving customer satisfaction can be done by increasing the effectiveness/the reduction of customer waiting time. The effectiveness of waiting time can be done by providing queueing information system which can be access by customer where ever they are, so customer can measure the right time to go. This way can avoid the wasted waiting time. By that way, someone can spend most of time to do another usefull activities.

Implement queuing system has been done by John G. Lert, Jr. who has made specifically retails goods order and production management queuing system. With this sistem, customer can chose whether they want to directly order through the service personel or the queuing system[10]. Queuing online system also has been widely implemented to compare between using online queuing system and offline system for hight or low priority sending packets[11].

Queuing research and deveopment system has been done by many method such as simulation and modelling of customer queuing system at Semarang XYZ payment counter [12] and also queuing modeling system with simulation method [13]. The other study about queuing system like analisys of USU PT. Bank Negara Indonesia branch Office customer queuing system[14] .

Although queuing system has been developing or implementing widely, we can still improve services and enjoyable quality of this system by inovation to this system. one

of innovation that we can do is developing online integrated all of public queuing service system. By integrating system, public just use an application to served by many service counters especially at public services which alway serve in queue situation. Ability to access services time information using mobile is one of innovation that must be integrated as application fitures. Mobile as device to acces time service information choised because Mobile Phone is one of ICT devices which easy and cheaper to buy by farious community type. This information known by higher level of ownership of mobile phone then ownership of computer or laptop in Indonesia[15].

Base on that problems, integration mobile queuing management system is design to streamline public waiting time which can use on government or private office. We do hope public can more enjoy and confort to spend their waiting time because they can wait their turn to services not in line situation. They can check information services from mobile wherever they want. Beside that, with integration of queuing system, public allow register to serve in several public service on the same time

In this system design and analisys, we just explain part of system which using by customer and counter public services. System part of admin wouldnt explain because this part should be developed with web base platform, not by mobile application platform. Result of this design are application models and prototype. This system prototype has not yet implement directly by customer or counter office but implemented by simulation when this application has developed. More details, the goals of this study is to make design of queuing management system which has ability to integrated all of queuing system into single mobile application which contain three urgent fitures namely queuing position number, time estimation services and list of queuing system places. The main difference with other queuing online system is that this system tries to integrate entire online queuing system into single application.

The result of this study expected to give benefits:

1. Contributing to the existing queuing system innovation.
2. With the integration all of queuing system into single application, it is expected to improve services to public.
3. This study can be a solution to implement queuing system with low budget for government or private instance what need or did not have enought budget to buy or develop queuing system.

II. METHOD

Data collection method using observation and literatur review. Literatur review is a data collection by reading journals paper and related reading with research title[17]. Literature review method has choosen because data and information needed has been providing in online or conventional research published. Observation is another method which using to complete the data study by observe some of government and private instance which used to implement manual or electronics queuing sistem. As for some place what observed are places which still using manual or electronic queuing system such as a government public services and some of healt clinick in Makassar city and Gowa district.

This study using Software Development Life Cycle (SDLC) as system development method. This method is traditional development method what using by most of system right now. SDLC is structured framework that contain sequential process of information system developed [16]. Steps of SDCL method consist of system planning, system analisys, system design, system implementation and system testing. in this ocasion, we will only explain system planning, system analisys and system design.

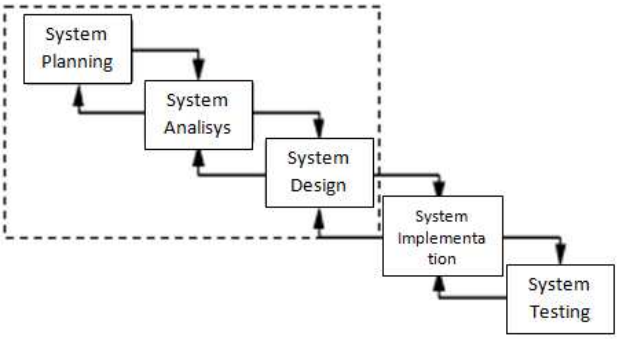

Fig 1. SDCL Steps [18].

Steps explanation:

1) System Planning: Planning is a basic process to understand about system to be develope. This step need feasibility analisys to find data or to process users information gathering.
2) System Analisys: this is a investigation running system proses to answer aquestion about who is the users, how this system work and using. From this analisys proses we will get the way how to build new system.
3) System design: design system is process to define system work in architecture design, interface design, database, files spesification and program design. This process will be found system spesifications.

III. RESULT AND DISCUSSION

A. System Planning

From observation doing, we found than how tired and how many time wasted in waiting queuing process. This is because registration, wating time and all process are doing in the same place continuesly without delay time. An innovation is required here to reduce wasting time so that people can spend their time with other procuctive activity before get services. On the other hand, there are a lot of public services have not enought resources to provide queuing system by themselves. As a solutions for both problems, a system integrated to help users in registration, access queuing information from anywhere and services estimation time is need to be design.

B. System Analisys

After planning, some of general analisys process are needed. In this step, analisys about running system is doing by parse system to be parts or components in defining main problems, constraints and opportunity, and also system required to develope new better system.

Generally, system analisys consist of:

1) Identify existing system problems
2) Determine the goals to be achieved in fulfilling the system to be develop

3) Determine alternative identified problems methods or solutions.
4) Implement possibility of system design to fullfill user needs

The analysis phase is a very urgent and sensitive stage because errors at this stage will cause identification errors that might also cause errors in making alternative problem solutions that will automatically cause errors at all stages of further system development. In the system analysis phase there are steps that must be taken, namely:

1. Problems analisys
   To understand about the problems related to the queue, we need to understand the factors in the queue system, that factors are [19]:

a) Arrival distribution
   There are two types of arrival distribution queue namely single arrivals and bulk arrivals

b) Time services distribution
   Time servides distribution consern abaout sum of provided facilities. There are two Types of this services namely single service bulk service

c) Services fasilities
   Services fasilities consern about how many queuing line that will be made. There are three line types services fasilities namely series line (single stright or ring line), paralel line (some of parrarel lines) and network station (can be design series or parrarel line with more then one stations).

d) Services diciplines
   Services diciplines consern about queuing tipe used to solve queuing problems. There are four queuing type namely:
   - FCFS = First Come First Served
   - LCFS = Last Come First Served
   - SIRO = Service In Random Order
   - Priority services (VIP customer)

e) Size of Queuing
   Size in the queue Regarding the size of the queue of customers who will enter the service facility. There are two designs that can be chosen to determine the queue size includes infinite queue and finite queue.

f) Source of Calling
   Generallly in queuing system, machine or humans can be source of calling but in this system source of calling just using machine throught notifications of mobile application. There are two types of call sources, namely finite calling source and infinite calling source.

g) Queue basic structures[20]
   There are four models of queue basic structure:
   a. Single Channel – Single Phase
   b. Single Channel – Multi Phase
   c. Multi Channel – Single Phase
   d. Multi Channel – Multi Phase

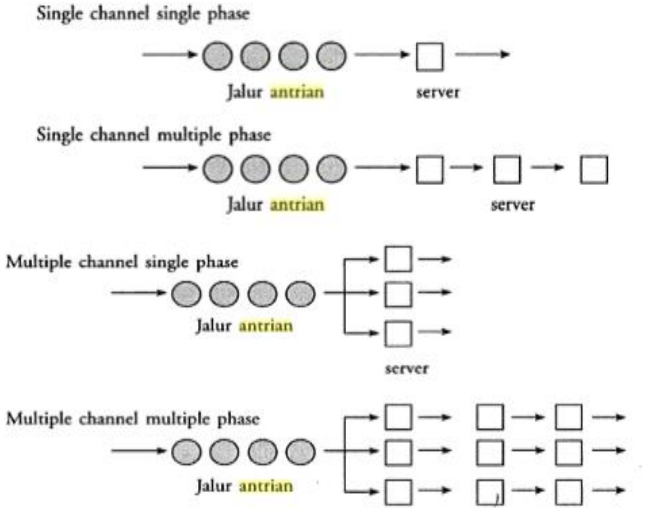

Fig.2. Queue basic structure types

Not all of queuing type can implement as solution for online queuing system. FCFS is the best type to solve all of customer queuing system, other queuing method can implement on dinfferent type of queuing like telephone istalation. FCFS method is very efective and eficient to implement on queuing customer services because customer who has been arriving earlier will serve firstly and then next coming if using this method. arrival in the online queue system can show from the order of registration. In this design, System will more ideal if using services multi counter and single chanel-single phase structure because users register themselves at the desire counter.

2. Requirement analisys

At this stage an analysis of the requirements of the system is carried out, analysis of requirements based on the type of device includes the software specifications and hardware needed to develope this application. The requirements that means are:

1. Software spesifications :
- Android SDK as a tolls to develope android application
- WAMP as web server
- MySQL as database
- Android Studio as IDE android application

2. Hardware spesifications:
- 1 set PC Core i3 Proccessor, RAM Min 4 GB. (CPU, Keyboard, Mouse, dan LCD Monitor standard)
- 1 unit HP android min android V 4.
- 1 Unit Data cable

At this requirement analysis, system requirements will also be determined based on entity designed, such as:

a). User entity requirements

Based on the description of the literature study on the requirement analysis, it is found that the candidates entity are user, counter and administrator

b) Data entity recruitments

After identifiying users requirement, next step is identifiying data identity needed. Data identity of this system are:

TABLE 1
Data identity of system

Data identities	User		
	Customer	Counter	Administrator
Customer data	C	U	U
Services data	U	C	U
Places data	U	U	C
Registration data	C	U	U
Counter data	U	C	U
Services Position data	U	U	C
Waiting time estimation data	U	U	C
Login data	C	U	U

Customer data, places and counter data are actor data entity candidates. Beside that, there are data candidate which needed by system such as services position data,waiting time estimation, service data and login data. Realtion between user and data entity show in matrix model like Table I. User identity will determinet whether Create (C) Use(U), Reference (R) on every data entities.

3. Entity Relationship Diagram (ERD)

ERD can be describe as explaining content and relation data model in database through form of entities, attributes and entities relationship. ERD is needed to design the basic model of data structures and relationships of each data. ERD analysis of the queuing system to be built can be shown in Fig 3.

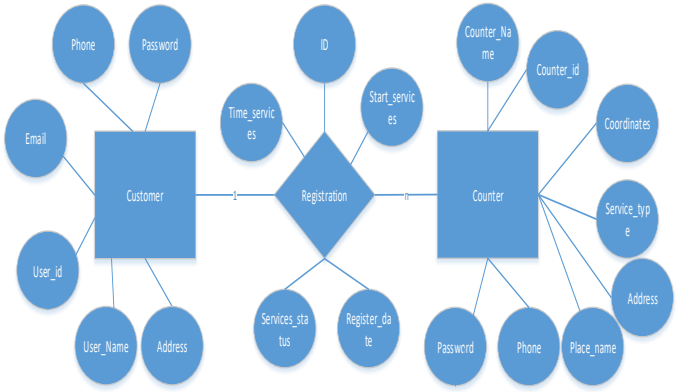

Fig. 3. ERD Mobile Queuing system

ERD show the relationship between the customer and counter. From this ERD then we can determine tables in database. there are three tables will create to develop this queuing system namely customer, registration and counter tables. This ERD should be reference to create database and all of table fields.

4. Requirement spesification

Section of requirements specification will describe the system requirements in detail such as functional requirements and non-functional requirements.

a) Functional requirements

Functional requirements that must be provide in this system include registration, notification and View. The system allows users to register, obtain notifications and display estimated service time information and current customer positions services in real time. In counter sides, the main function that must be present is preparation a simple button calls to the next customer.

b) Non-Functional requirements

Non functional requirements include operational requirements, performance, and security. Relating to operational requirement, the system is expected to have user-friendly capabilities to make users feel more helpful when using system; the system can be accessed anywhere, anytime and allow to display from android phone well (responsive).

Performance : The system is expect to be able to run along day, has good speed access where updates data changed will immediately appear without delay; Security : The system will provide security to grant user through authentication of username and password that need to be entered at the beginning of using system.

5. Choosing the right system

To develope a good system needed the best choosing of strategy, entry method, system processing and output system. the right choosing of this system are:

a) Choosing system strategy with using centralized processing and integgrated database.
b) Choosing system entry using online data entry.
c) Choosing system processing. Provide real time record updating; and give chance no only to single user to update records (Multiple-users) with certain limitation.
d) Choosing output system. Output of this system using notification and display service position information and also estimation waiting time to get services.

6. System feasibility analisys
7. Feasibility analysis of the system includes

a) Technical feasibility. It is expected that the existence of this queuing system can provide solutions to problems related to the service waiting process starting from registration, waiting process, notificationand all process until user has served.

b) Operational Feasibility. Operational feasibility assessed using PIECES (Performance, Information, Economy, Control, Effieciency, Service) framework.

Performance : the queuing system has good performance or ability to acces by user and counter personel well;

Information : This queuing system can display information in real time accurately regarding the estimated time and current service position;

Economy : This queuing system minimize budget of public services to provide queuing system expensive prices by them selves.

Control : This queuing systen provides a good fitures for user to control their account.

Efficiency: Besides finance efficiency, implementation of this system also will reduce wasting time and energy in carrying out each stage of the queue.

Service: This system provides services in the form of a queuing system that can integrate all existing queue services so that people can register in various service services through one application.

C. System design

Acyivities in this stage are system modeling, structure menu design and application interfaces design.

a) System modeling

System modeling use to determine the functions that using in system and determine the classes needed for the realization of the functions of the system. All of function and class show using diagram. System modeling which using to describe system work flow using Use Case and Activity diagram.

1. Use Case Diagram Used to find out what functions are in a system. The function emphasized in this diagram is "What" system does, not "How". Use Case Diagram of queuing system present in Fig. 4.

Fig. 4. Use Case Diagram

2. Activity Diagram

Activity diagram is a part of system to system functionally what explain logical process or function what will implementing by programs syntax. All of process from the begining until the last process should present in activity diagrams to describe activities happen in system. Activity diagram of this queuing system presented in fig 5 and 6.

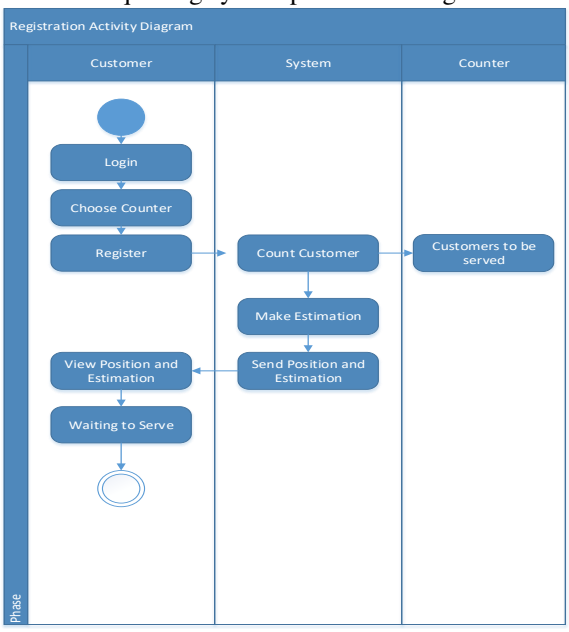

Fig. 5. Registration Activity Diagram

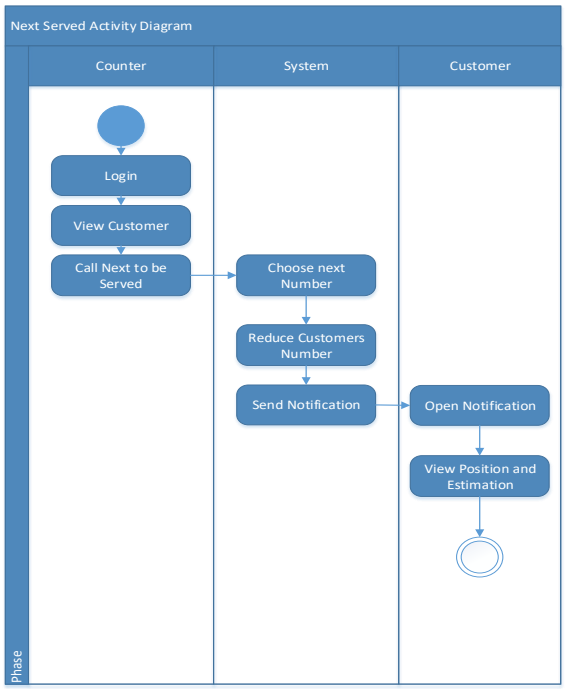

Fig. 6. Next services Activity diagram

b) Menu structures design

Menu structures design of queuing system devided into two parts base on user type. Menu structures for Customer showing in fig 7 and menu structures for counter showing in fig 8.

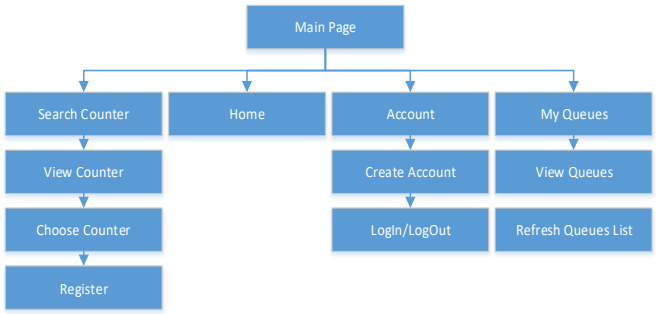

Fig 7. Customer Interface Menu

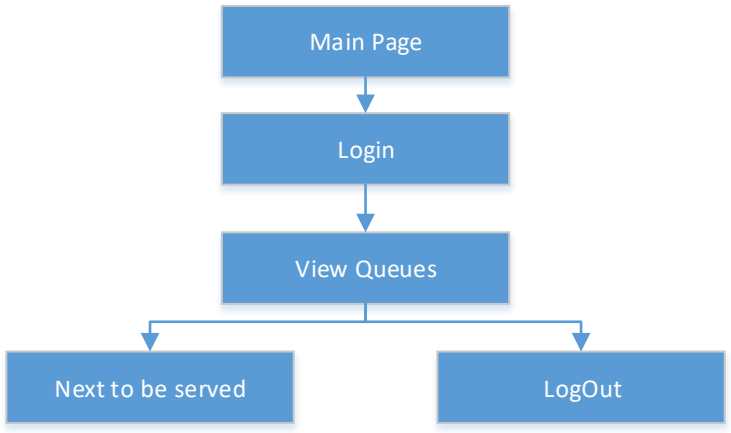

Fig 8. Counter Interface Menu

3. Database

Database is using to hold data by system. all data used in the system is entered and processed through the database before being forwarded to system actors and application. There are three tables covered by this database.

TABLE 2
User Table

Field	Type	Width	Description
User_id	Int		Asc
User_name	Char	20	
Password	Char	12	
Address	Char	25	
Email	Char	30	User email
Phone	Char	12	User Mobile number

TABLE 3
Counter Table

Field	Type	Width	Description
Counter_id	Int		Asc
Counter_name	Char	20	
Password	Char	12	
Address	Char	25	
Place_name	Char	30	Services place name
Phone	Char	12	Office phone number
Coordinates	Long		Place coordinates
Type_of_Services	Char	20	Bank, clinick or other

TABLE 3
Registration Table

Field	Type	Width	Description
Id	Int		Asc
User_id	Int		User id
Counter_id	Int		Counter id
Register_date	Datetime		Register date
Services_status	Boolean		False as default
Time_services	Datetime		Null as default
Start_services	Datetime		Daily time start services

4. Interface

All of interfaces design of this system are present in Figure 9-15.

Home page of this application includes search place name, list of place services type, account and my queue system. Search and list place services type function as fitures to help searching services place that provide counter services for user who need queue services more easy. Account button is a button to view user account information. MyQueues is a button to view user queue information who has regestered.

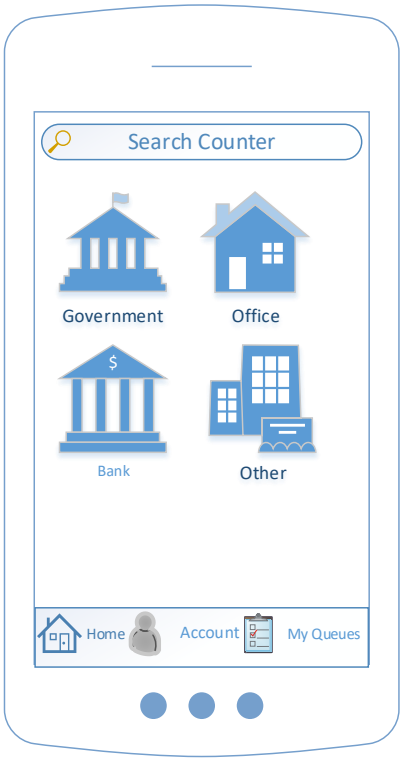

Fig. 9. Main page

Fig. 10. list of Services place

After user choose services place type, list of place name will shown to choose. if user choose clinick then application will show list of clinick what registered in database. list viewed in page shown base on services place type choosen.

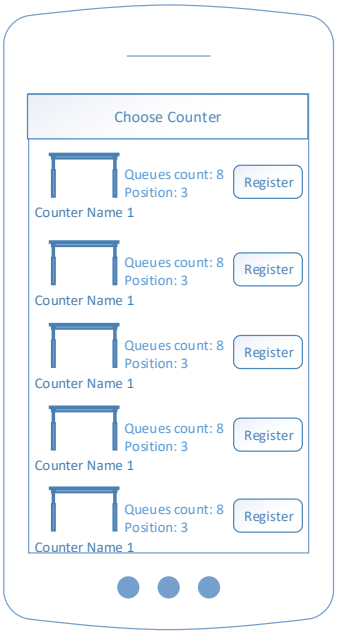

Fig. 11. Counter list

Above interface is counter detail information list. In this page user can get information about sum of user regeistered and user serviced position. this informatian can be consideration to determine counter to register.

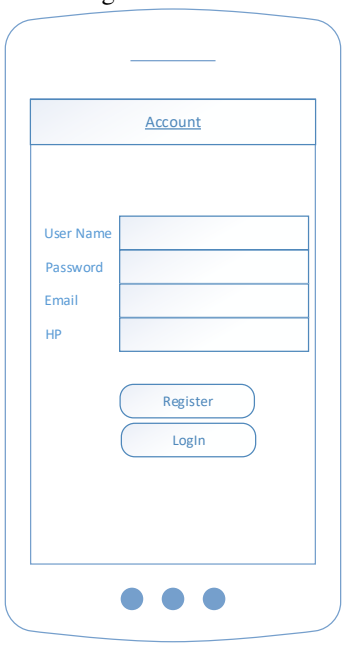

Fig. 12. Account interface

Account page is a page to register customer as user. every user who want to use this application must register them self throught this page. After register, user will allow to login to access all fitures in this application.

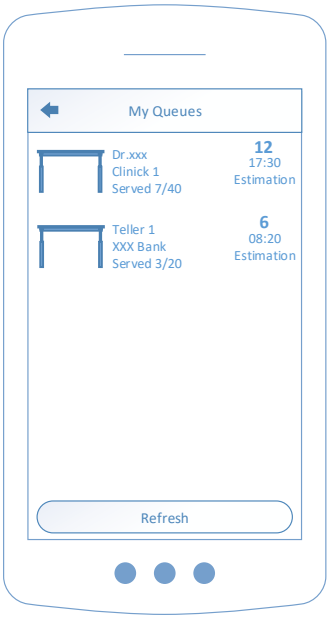

Fig. 13. Queue list

If user has register then all of counter choosen will show ini this page as user queues to services. All of urgent information shown in this page include sum of user queue and counter position services, user queues number and also time estimation to get services.

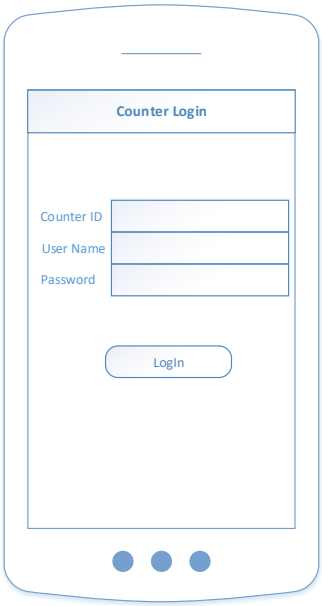

Fig. 14. Counter Login

As mention earlier, this application consists of two applications, one application for customer and one application for counter. the design of the login interface for the customer can be seen as shown in Fig 13. On this page, the counter must enter the counter id, name of the officer and password correctly.

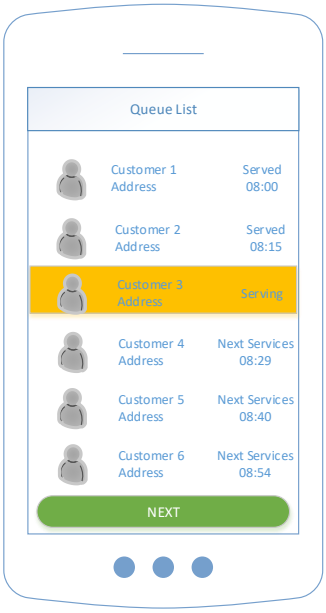

Fig. 15. Customer registered list

If User Name, Counter Id and Password are match, the system will display a list of registered customers. That list start from the first one register until the last user register at the day. The calling process is done through this page by clicking the next button. If the first customer has finish to serve and Next button clicked then the second (Next) Customer will be called immediately by notification via the application. and so on.

IV. CONCLUTION

This analysis and design has produced an application model that is able to become a portal to integrate all queuing services using First Come First Serve (FCFS) queue method. So, people just simply install one application but can register in various different service places. By following the SDLC scheme, this application has been design to fullfill information and communication needs, especially information on queue position and estimated service time so that people who want to get services can register and wait for services from anywhere without wasting a lot of time in pain. This design has produced a queuing application model that is ready to be implemented as a mobile-based application.

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